Sept. 15, 1970 S. H. McCAUGHEY 3,528,575

FEED AND TRANSFER SYSTEMS

Filed March 18, 1968 8 Sheets-Sheet 1

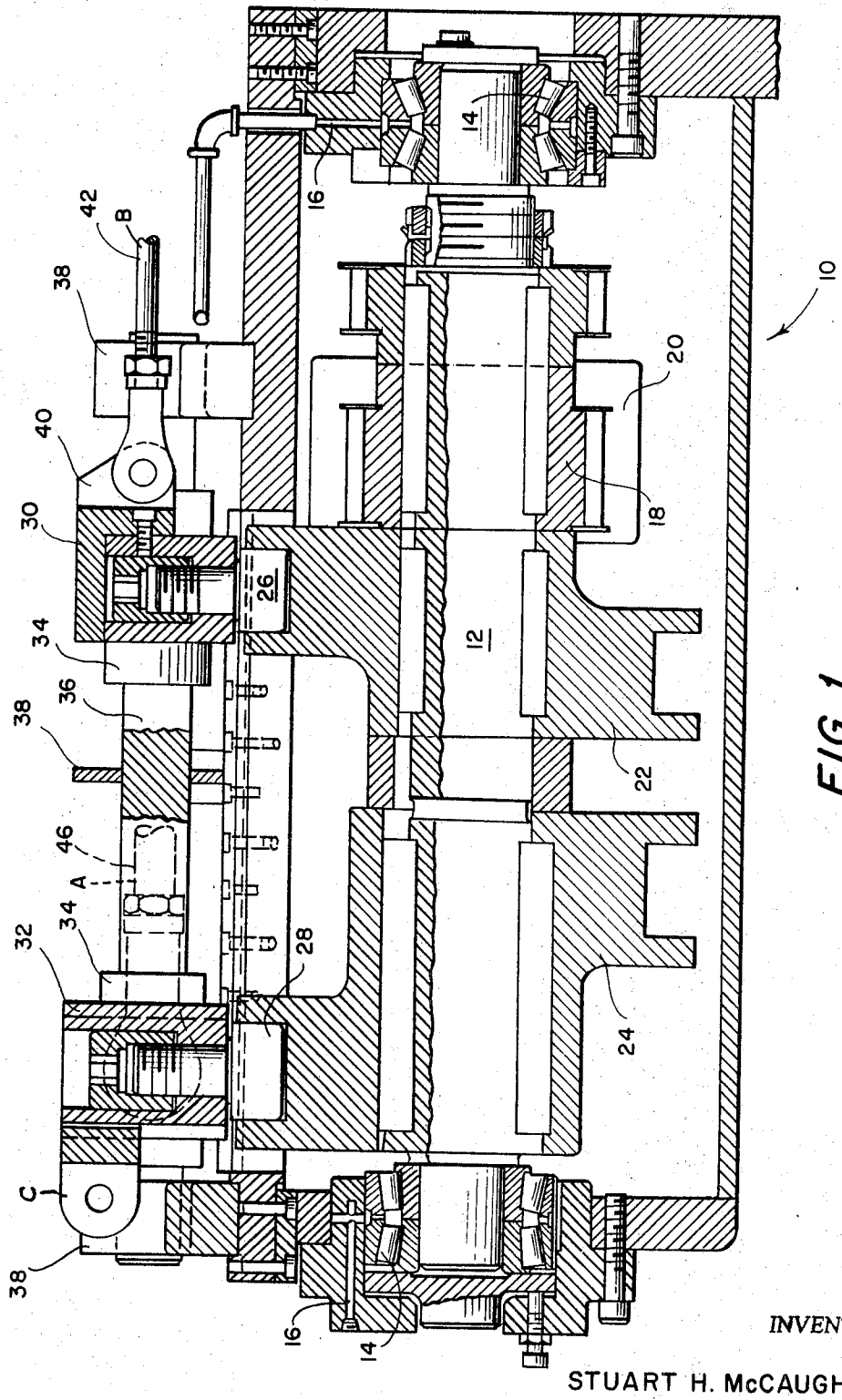


FIG. 1

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FEED AND TRANSFER SYSTEMS

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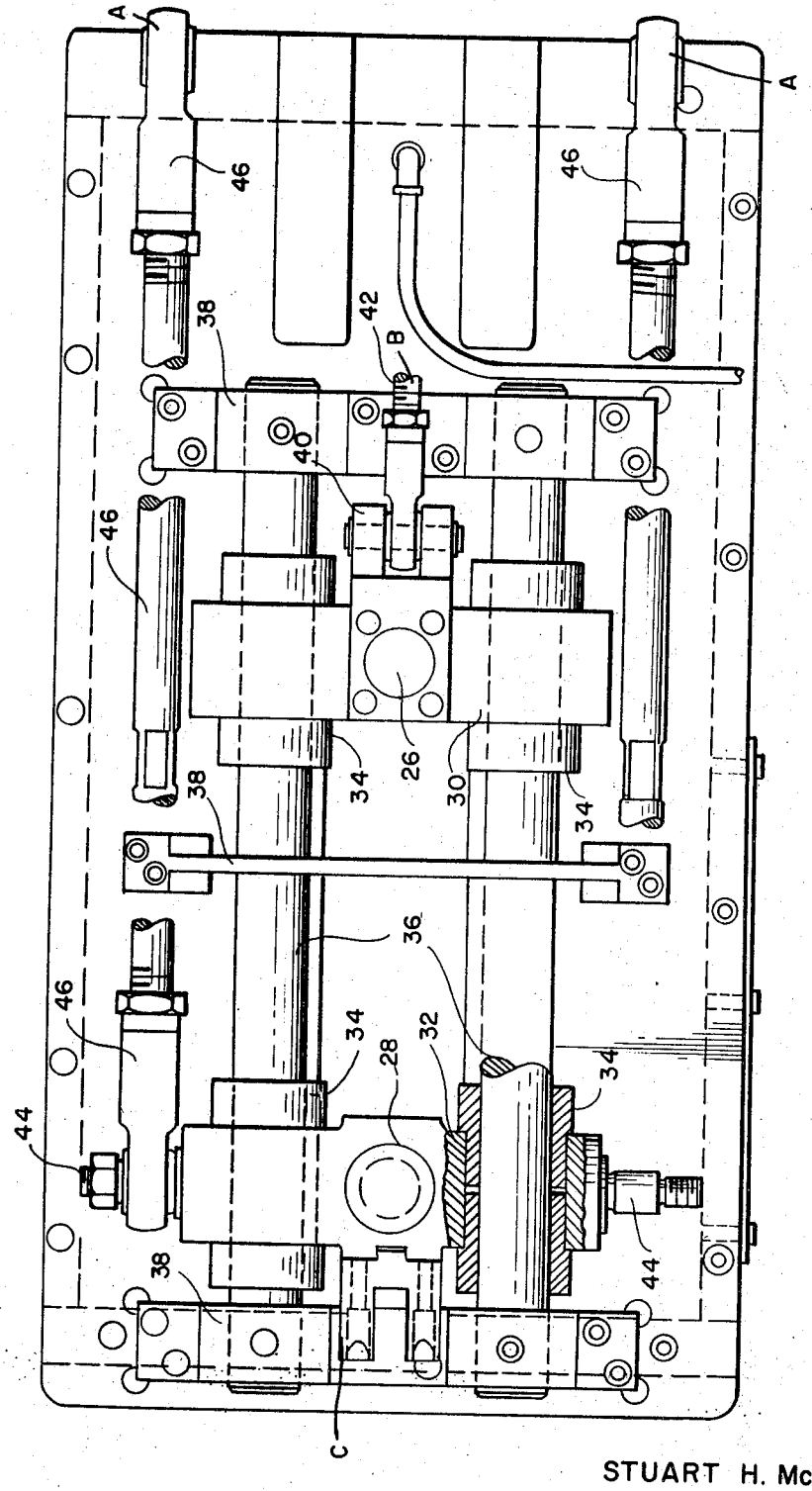


FIG. 2

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FEED AND TRANSFER SYSTEMS

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FIG. 3

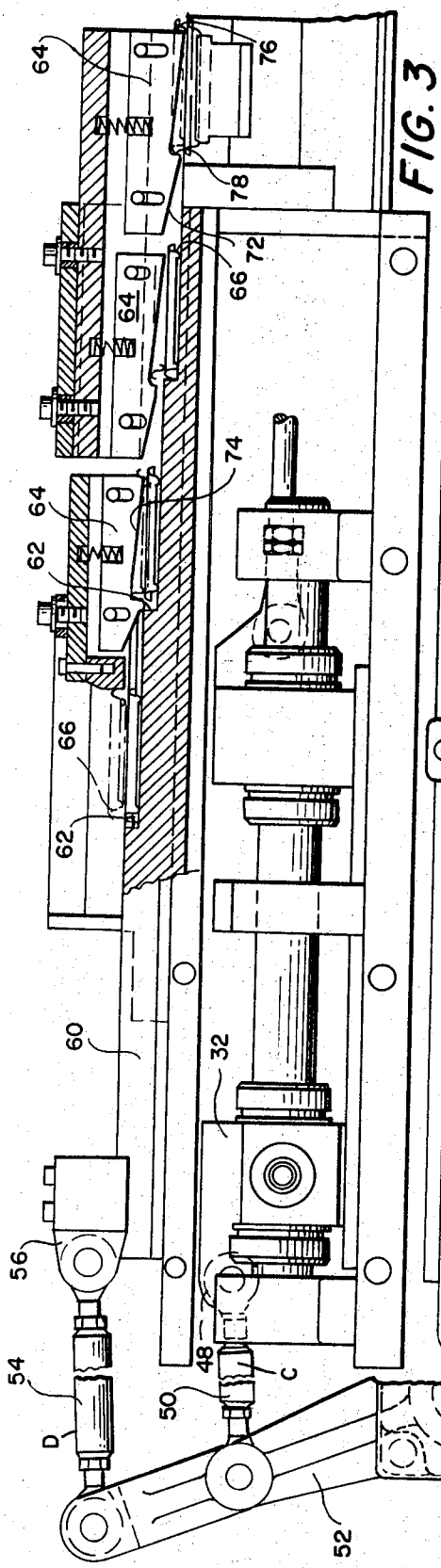
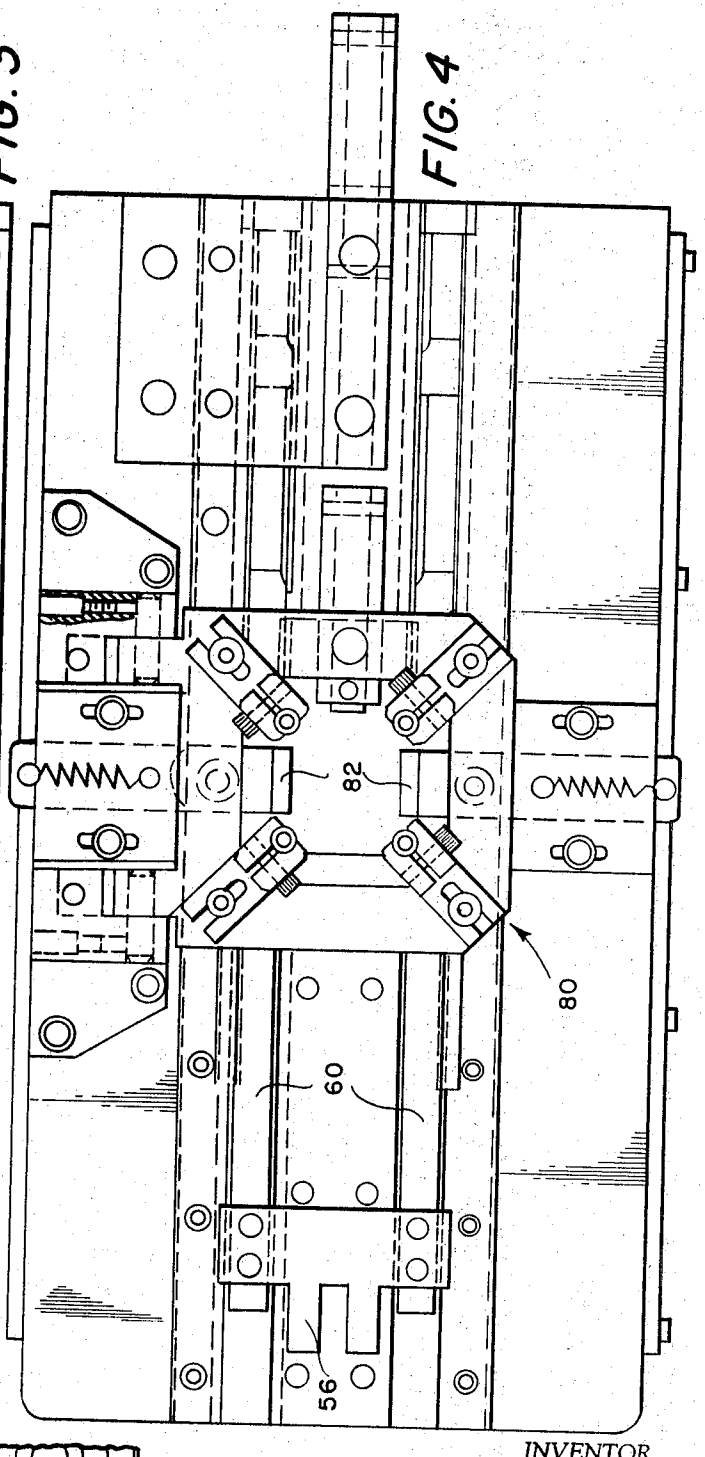


FIG. 4



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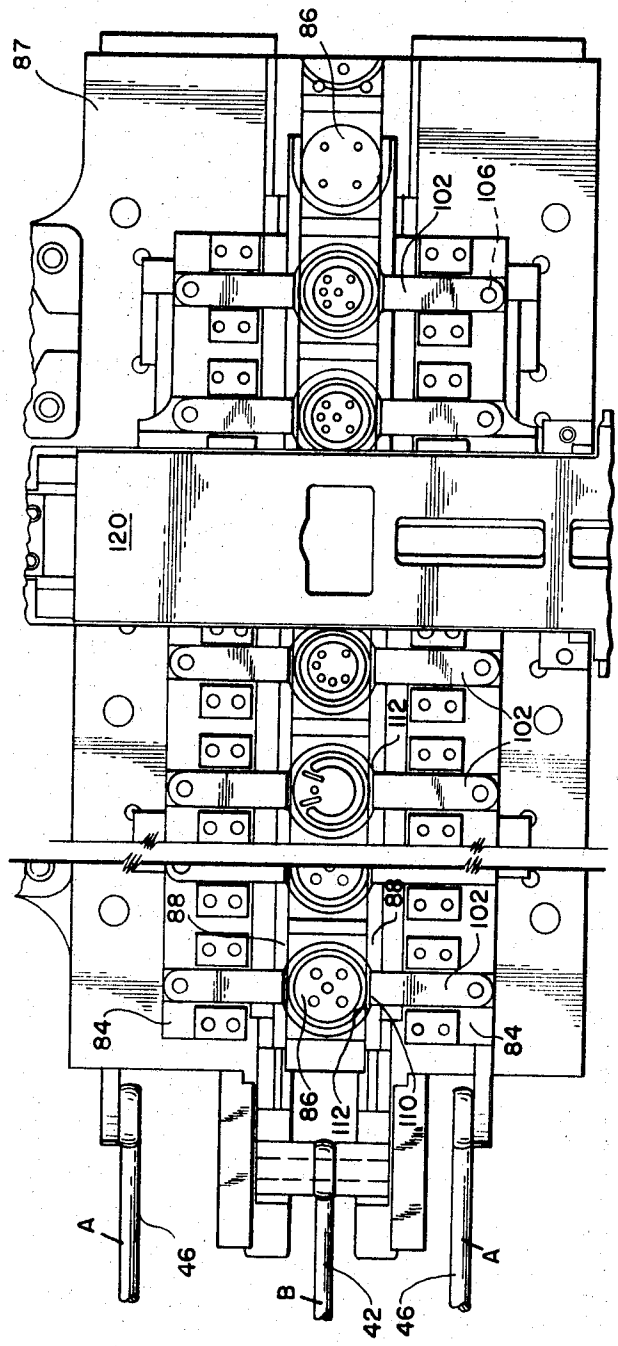


FIG. 5

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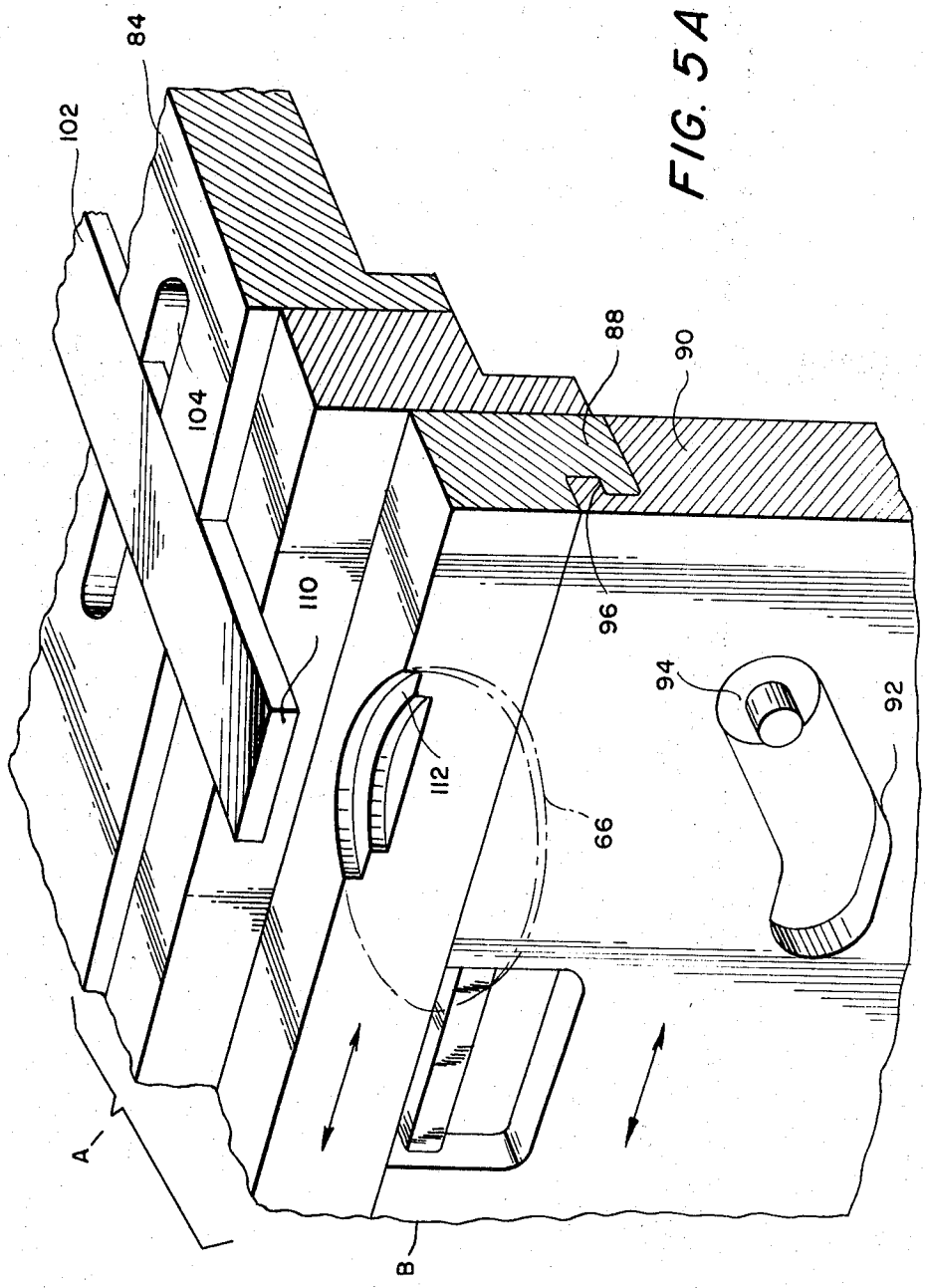
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Filed March 18, 1968 8 Sheets-Sheet 5

FIG. 5A



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FEED AND TRANSFER SYSTEMS

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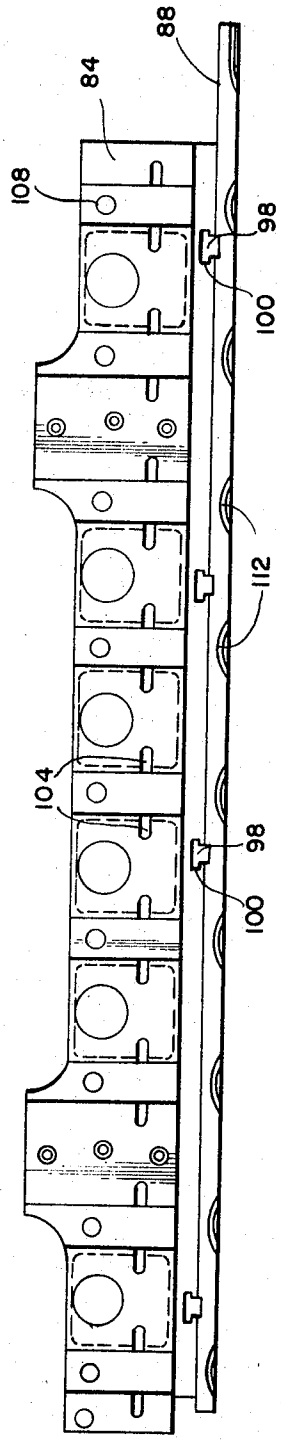


FIG. 7

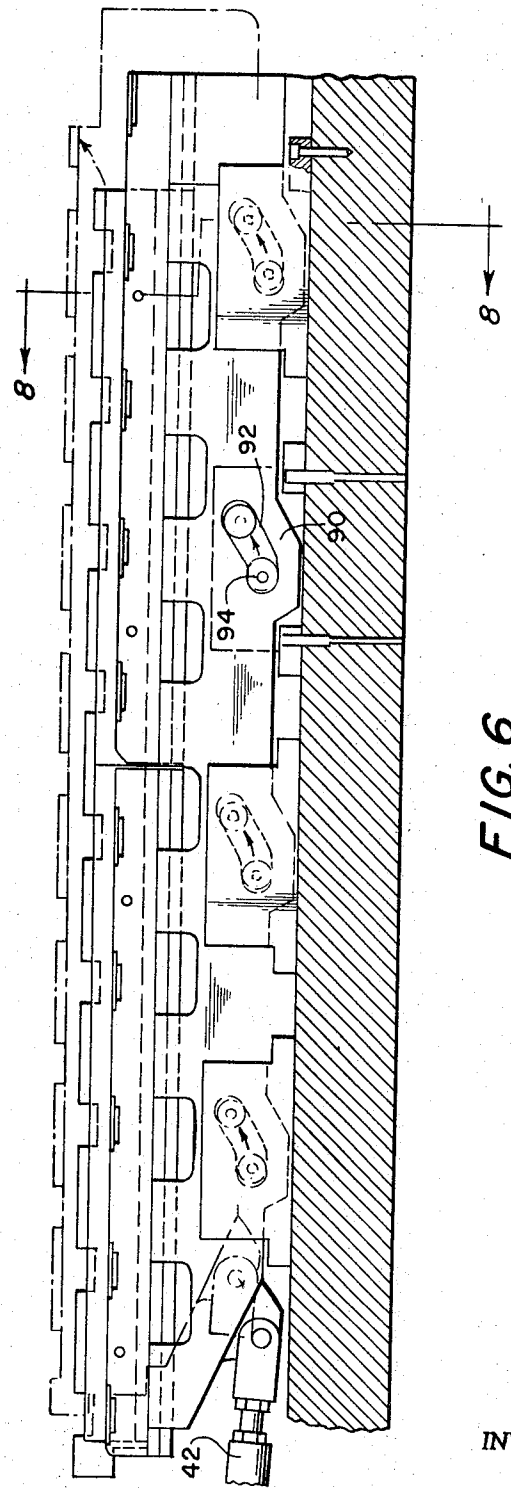


FIG. 6

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FEED AND TRANSFER SYSTEMS

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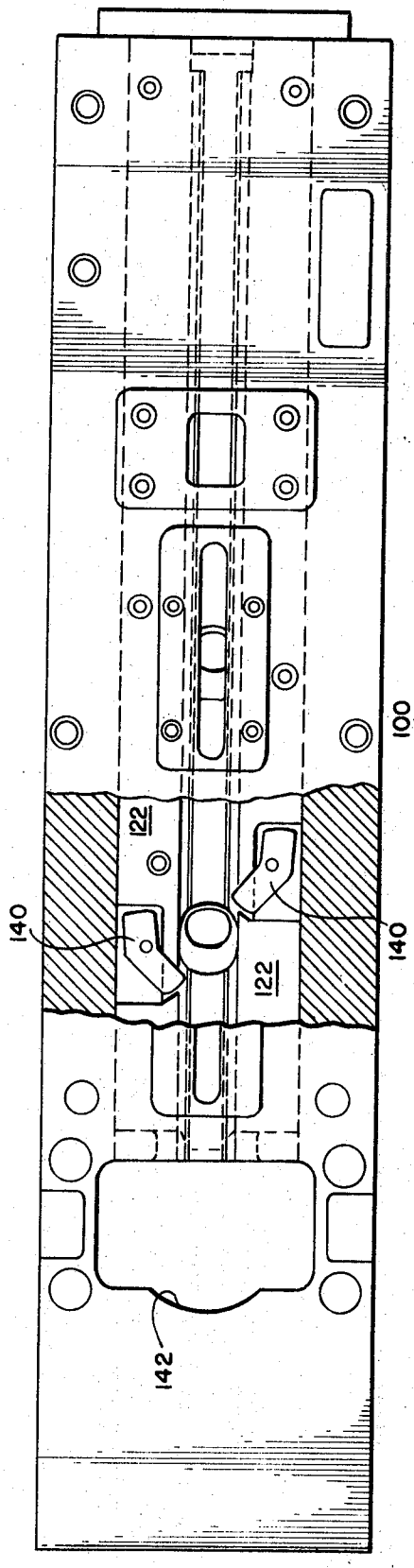


FIG. 9

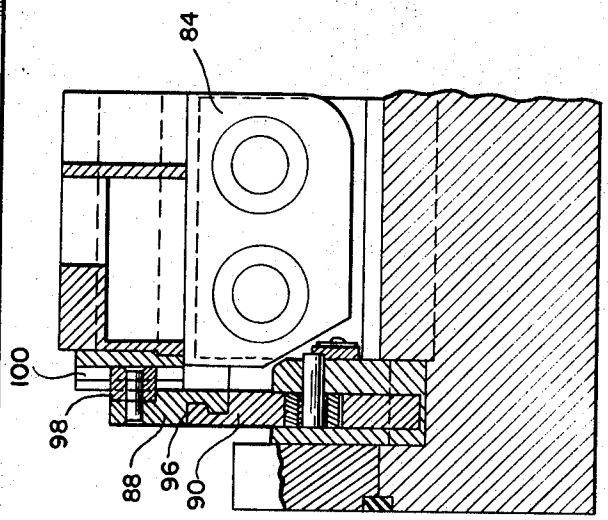


FIG. 8

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FEED AND TRANSFER SYSTEMS

Filed March 18, 1968 8 Sheets-Sheet 8

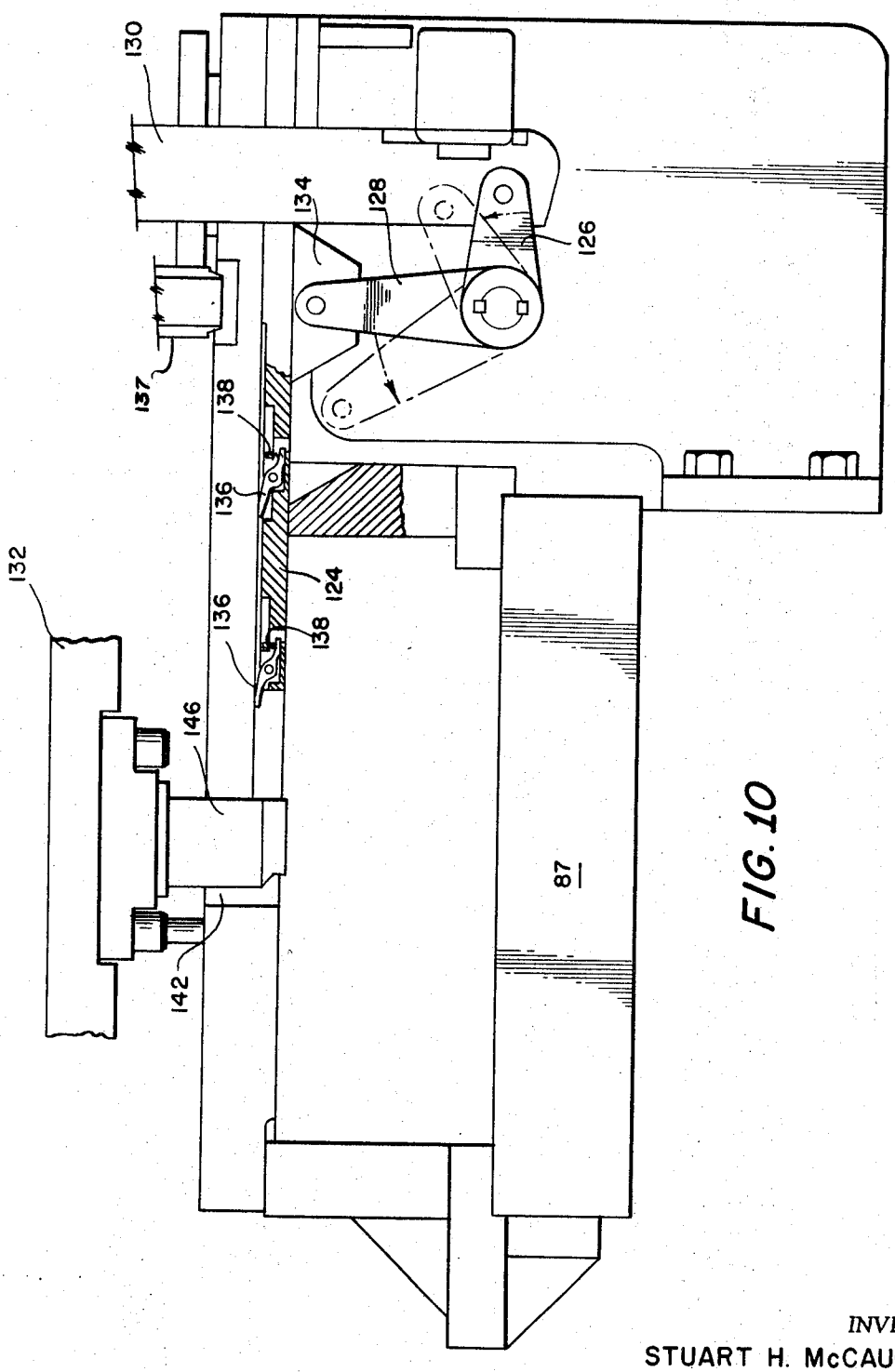


FIG. 10

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3,528,575

FEED AND TRANSFER SYSTEMS

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Filed Mar. 18, 1968, Ser. No. 713,830
Int. Cl. B65g 59/06
U.S. Cl. 214—8.5 8 Claims

ABSTRACT OF THE DISCLOSURE

High speed transfer feed systems are disclosed herein. Feeds have reciprocating multiple-stepped single blank feeding plates with cooperating blank holders. Recessed transfer bars with spring loaded gripping fingers reciprocate differentially with respect to cammed lifting bars which are slidably connected to the transfer bars. The lifting bars lift the transfer bars into contact with blanks before the transfer bars are moved forwardly and lower the transfer bars out of contacts with the blanks after the transfer bars are moved forward to a maximum position and before the transfer bars are returned to their rearward positions. The feed, the transfer bars and the lifting bars are interrelated with cams and lever to coordinate their movement.

BACKGROUND

Material handling systems such as feed and transfer systems have many and varied applications. The need for improved feed and transfer systems is especially acute in high speed presses. Consequently, the invention, while not limited for use therewith, will be explained with particular reference to that application.

Known transfer and feed systems, while satisfactory for low speed and medium speed, have drawbacks which render them unsatisfactory for high speed operation. Modern high speed presses as a rule are capable of far greater production rates than the rates at which they are used. Transfer apparatus are often the limiting factor. Workpieces which are not well engaged and held during the rapid accelerations which they undergo while being transferred between work stations tend to float and misalign, causing high reject rates or jamming of the machinery and necessitating high percentages of inspection or sampling. Forces which cause floating and misalignment increase with the square of cyclic speed.

Well known transfer systems require inward movement of transfer fingers toward die stations, movement between stations and movement outward from stations. The inward and outward movements increase transfer time between press cycles. When the dies and workpieces are of shapes which do not permit unidirectional transfer, additional relative movements must be provided for. Modern high speed presses have speed capabilities far beyond the capablities of available transfers and feeds. Research continues toward the development of transfer and feed apparatus which will keep pace with high speed presses. Many recent developments have employed conventional laterally opposed forks which move in a single plane inward to grip the workpiece, forward to advance the workpiece and outward to release the workpiece.

THE INVENTION

The invention provides feed and transfer systems for advancing articles and for moving articles from station to station such as in presses. Feed and transfer systems described herein are designed for operational speeds in excess of 300 cycles per minute. In each movement the articles are positively held to prevent floating and to provide means by which articles can be transferred with

accelerations greater than gravitational accelerations. Motions and masses of feed and transfer equipment are held to minimums in order to minimize forces due to acceleration, since excessive movements, accelerations and masses create excessive forces which have adverse effects upon operation of equipment.

The feed and transfer apparatus of this invention may be driven by any convenient reciprocating drive. Since it is usually desirable to drive the feed and transfer synchronously with an article-working machine, the power for the drive unit may be taken directly from a shaft in the machine drive. In the present case, chain belts interconnect notched pulleys, the machine drive shaft and the feed and transfer drive shaft. Barrel cams keyed to the latter shaft and cam followers provide reciprocating drives for the feed and transfer apparatus.

Workpieces are unstacked from the bottom of a stack with a conventional stack stripper in the first step of the process. Individual workpieces are placed on the first position of a notched feeder which also may be referred to as a stepped feeder, that is a feed device having successive positions for holding and feeding articles. Forward motions of the feed means and workpieces move retainers which are associated with each notch. At the end of the forward travel, the retainers move toward the feed means holding the workpieces against recession and urging them to the next notch. Thus workpieces are advanced step-by-step with each reciprocation of the feed means. The end of the feeder pushes a workpiece into an initial portion of a transfer apparatus.

The unique transfer apparatus of this invention is largely responsible for the high speed operation which heretofore has been unattainable. Workpieces are lifted from station to station while being positively gripped. Two basic elements are driven by the reciprocating cam followers of the transfer drive assembly.

A pair of lifting bars are reciprocated on opposite sides of the work stations, and sloped surfaces on the bars cooperate with fixed rollers to create raising and lowering actions.

Carrier bars are connected to the lifter bars for relative longitudinal sliding therewith. The carrier bars are driven by a separate cam and follower in the drive assembly so that the carrier bars successively are urged upward by the lifting bars, are driven forward by the carrier bar cam, are pulled downward by the lifting bar and are moved rearward by the carrier bar driving cam. Inward upper edges of the carrier bars are recessed at intervals corresponding to spacings between stations. The recesses are aligned with work stations during vertical movements so that the recesses receive edges of workpieces as the carrier bars are raised and release the edges of the workpieces as the carrier bars are lowered into alignment with successive work stations.

Spring loaded arms are pivoted on longitudinally oriented pins which are mounted in lateral extensions of the carrier bars. Inner ends of the arms are urged downwardly over the recesses in the bars to hold workpieces firmly in the recesses. The function of the arms, while important throughout the whole transfer operation, is especially important during the downward movement of the carrier bars. During that interval accelerations greater than gravitational accelerations may be experienced, and the arms are necessary to overcome the inertia of the workpieces.

Another feed is used in an assembly operation to join additional parts with workpieces. The second feed which is described hereinafter in greater detail has a supply stack and a pusher block which is reciprocated within a stationary block. Movement of parts is accomplished by employing unidirectional spring-loaded detents or fingers

which prohibit backward movement of the parts. As the pusher block is moved forward, fingers therein carry the parts forward. Fingers in the stationary block hold the parts while the pusher is withdrawn so that they may be advanced in increments each time the pusher block moves forward.

One objective of this invention is the provision of an active gripping feed and transfer system for advancing articles at high speeds.

This invention has as another objective the provision of a combined feed and transfer method and apparatus in which articles are lifted, translated and lowered from one position to another.

A further objective of this invention is the provision of an improved transfer method and apparatus which employs lifting and lowering means, advancing means and gripping means for transferring articles between sucessive work stations at high repetitive rates.

Another objective of this invention is the providing of feed methods and apparatus which employ downward and forward stepped reciprocating pushers with cooperating transverse reciprocable retainers which are lifted by the pushers and articles thereon in forward feeding movement and which retain articles in forward positions and urge articles to successive steps of the pushers as the latter are withdrawn.

This invention has as another objective the provision of feed methods and apparatus employing stationary blocks and pusher blocks reciprocable therein, which blocks have cooperating unidirectional spring-mounted fingers for advancing parts in step-by-step motions.

Other and further objectives of this invention will be apparent from this specification, from the claims which are a part of the specification and the disclosure herein and from the further detailed description of preferred embodiments of this invention as shown in the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional elevation of a drive assembly for the feed and transfer system;

FIG. 2 is a plan view of the drive assembly of FIG. 1, showing cam followers and linkage for connection to the feed and transfer system;

FIG. 3 is a side elevation partially in sectional view, showing feed apparatus and driving apparatus for the feed;

FIG. 4 is a top plan of the feed apparatus showing in detail the unstacker;

FIG. 5 is a plan view of the transfer apparatus which also reveals the positioning of a tab feed;

FIG. 5A is a perspective schematic detail of the transfer apparatus;

FIG. 6 is an elevation of a lifting and lowering bar and carrier;

FIG. 7 is a plan view detail of a carrier support and carrier;

FIG. 8 is a section of a lift bar, carrier and support;

FIG. 9 is a plan view of a tab feed; and

FIG. 10 is a side elevation of the tab feed showing the driving apparatus and revealing details of the pusher block.

DETAILED DESCRIPTION

To make the drawings more clearly understandable, reference letters have been used to designate interconnecting links between related elements in the several sheets of drawings and to identify the operative equipment which takes motion from those links. The letter A generally identifies the carrier bars of the transfer and their driving linkage. The letter B generally represents the lifting bars of the transfer and their driving linkage. Letter C indicates a connection from a cam follower to a travel multiplying lever. Letter D indicates a connection from that lever to the feed.

The invention herein disclosed is illustrated by a specific embodiment of an application to a high speed press. The particular operation shown in the drawings and described herein is the feeding and transferring of can ends and the feeding of tabs. The press is fitted with dies to form and assemble tear-tab can ends which are used in the packaging of beverages. The press and the dies are not a part of the claimed invention, but they are illustrated for a complete illustration on one preferred embodiment of an application of the invention.

Referring to FIG. 1, the feed and transfer drive housing is generally referred to by the numeral **10**. Shaft **12** is mounted in bearings **14**, which are supplied with oil by channels **16**. Notched pulley **18** is keyed to shaft **12** and is driven by a notched belt **20**. Two barrel cams **22** and **24** are also keyed to shaft **12**. As discussed later, short travel cam **22** drives lifting and lowering bars in the transfer, while the long travel cam **24** drives the carriers bar and the feed.

As shown in both FIGS. 1 and 2, cam followers **26** and **28** are set in grooves of cams **22** and **24** respectively. Both of the followers have laterally extended bodies **30** and **32** which include slide bearings **34** for moving along stabilizing slides **36**. Slides **36** are supported above housing **10** by supports **38**. Body **30**, which is attached to cam follower **26**, has a clevis **40** which mounts linkage **42**. Linkage **42** is attached to the raising and lowering bars of the transfer as later described. Body **32** of cam follower **28** has pins **44** at its outward extremity. On pins **44** are mounted links **46** which are attached to the advancing means or carrier arms of the transfer.

As shown in FIG. 3, clevis **48** at the rear of body **32** mounts a link **50** which is connected medially to pivoted arm **52**. Arm **52** is a travel multiplier which is employed to increase the travel of the feed with respect to the transfer. The lower end of arm **52** may be pivoted at a fixed position, as for example on the drive housing. The upper end of arm **52** is connected to link **54**, which is in turn connected to a clevis **56** on feed bars **60**.

The feed bars **60** are stepped forward and downward at intervals to form ledges **62**. Spring mounted retainers **64** are pressed downward toward the feed bars. Retainers **64** ride over the ledges **62** and articles or can ends **66** when the feed is moving forward, i.e., to the right. Rearward facing slopes **72** and **74** on retainers **64** effect the raising of the retainers. After can ends **66** pass under retainers **64**, the forward edges **76** and intermediate ridges **78** of retainers **64** prevent the ends from returning. The retainers are then held upward by limit means while the ends are dropped to subsequent ledges. The last ledge deposits the articles in the first position of transfer apparatus.

FIG. 4 is a top plan of the feed which reveals the unstacking apparatus **80** with reciprocal bars **82** which pass can end one at a time to the upper ledge of feed bars **60**.

FIGS. 5, 6, 7 and 8 are respectively a plan view of a transfer assembled in the press, an elevation of one lifting and lowering apparatus and carrier, and a detail of a carrier and a support. Carrier supports **84** are constrained for reciprocation beside the dies **86** on the press bed **87**. Carriers **88** reciprocate with the carrier supports **84** and are moved up and down by lifting and lowering bars **90**. Cammed surfaces **92** in the bars **90** raise and lower the bars on stationary rollers **94**.

Bars **90** and **88** are interlocked at **96** for positive up and down action. Carrier **88** is held for reciprocation with carrier support **84** by rollers **98** moving in slots **100** in the supports.

Arms **102** are centrally pivoted in carrier support **84** by pins placed in pin slots **104**. Compression springs **106** in holes **108** urge the outer ends of the arms upward and the inner ends downward over recesses **112** in inward upper edges of carriers **88**.

In operation recesses **112** of carriers **88** are positioned beneath the exposed edged of articles or can ends **66** in the die stations. Cam **22**, follower **26**, and linkage **42**

move the bar **90** forward. Cam surface **92** and roller **94** force bar **90** upward. Carrier **88** moves upward with bar **90**, bringing recesses **112** into contact with the exposed edges of the workpieces. Carrier **88** continues to move the workpieces upward into contact with arms **102**, raising the inner edges **110** of the arms against spring pressure.

Cam **24**, follower **28** and linkage **46** then move carrier support **84** and carrier **88** forward with the workpieces locked tight in recesses **112** by arms **102**. When the workpieces are over the next adjacent stations, cam **22** withdraws bars **90**. The cam surface **92** and roller **94** pull bars **90** and the attached carriers down. In the initial part of the downward travel, arms **102** retain workpieces in recesses **112**. Arms **102** are stopped when they reach the full extent of their downward travel and the carriers **88** continue downward leaving the workpieces in the stations. Then cam **24** withdraws carrier supports **84** and carriers **88** to their initial positions.

As shown in FIG. 5, tab feed **120** overlies the transfer apparatus. As shown in FIGS. 9 and 10 the tab feed has a stationary block **122** in which pusher block **124** reciprocates. Movement is imparted to pusher block **124** by rigidly interconnected pivoted angle arms **126** and **128**.

Arm **126** is connected by a slide to bar **130**, which is rigidly mounted to press head **132**. Arm **128** is connected to a slide moving with a vertical groove in a downward extension **134** of pusher block **124**.

Pusher block **124** receives tabs **125** from a stack means **137**, and spring mounted fingers **136** move tabs forward with pusher block **124**. The fingers are mounted with springs **138**, and they are unidirectional so tabs may freely slide over fingers **136** as block **124** is withdrawn. Spring mounted fingers **140** in stationary blocks **122** aid in the step-by-step advancing of the tabs. In this manner tabs move forward to hole **142** where they are forced downward by cooperatively configured die heads **146** for assembling the tabs **125** with can ends **66**.

As shown in FIGS. 5 and 10, auxiliary feed **120** is positioned immediately over the dies and transfer on press base **87**. Thus die head **146** receives tab **125** in hole **142** as the head is moving downward. The die head continues to move downward, driving the tab to the exact desired position on the can end, and continued movement of the die rivets the tab to the can end.

All other known tab feeds for similar assembly operations have used vacuum to pick up and hold the tabs, and those devices have been unable to pick up and deposit the tab exactly in the desired position. Moreover, additional riveting steps have been required. The former operations have resulted in misplaced tabs and in high reject rates.

Although this invention has been described in part by a specific embodiment, it will be obvious to those skilled in the art that modifications and variations may be made to this invention without departing from the invention.

I claim:

1. Article feed apparatus comprising:
frame means,
reciprocating drive means connected to the frame means and to a source of power,
notched feed means slidably mounted on the frame means and connected to the drive means for reciprocation therewith,
retainer means movably mounted on the frame means for movement into and out of engagement with articles on the feed means, the retainer means being normally positioned in engagement with the upper side of articles on the feed means and being adapted to be moved out of engagement with the upper side of articles on the feed means by forward movement of the feed whereby the retainer means releases articles for forward movement with the feed means, engages articles and prevents articles from moving backward with the feed means, and promotes passage of articles to next adjacent notches upon reciprocation of the feed means.

2. The apparatus of claim **1** wherein the notched feeding means comprises a series of forward and downward stepped ledges, whereby articles move to successively lower steps.

3. The apparatus of claim **1** wherein the retainer means are constrained for reciprocal movement toward and away from the feed means, and wherein the retainer means define backward-facing slopes, whereby forward moving feed means and articles thereon initially contact the slopes and move the retainer means away from the feed means.

4. Article feed and transfer apparatus comprising:
a frame means,
supply means mounted on the frame means for holding articles,
feed means connected to the frame and to the supply means for moving articles from the supply means, the feed means comprising stepped means mounted for sliding adjacent the supply means for receiving articles therefrom, reciprocating means connected to the stepped means for reciprocating the stepped means adjacent the supply means, and retaining means moveably mounted with respect to said supply means,
transfer means connected to the frame means and positioned adjacent the feed means for receiving articles therefrom and for moving articles along a line, the transfer means having lateral displacing means for displacing and returning articles away from and toward the line, advancing means connected to the displacing means for advancing articles in the direction of the line when articles have been displaced from the line, and gripping means mounted on the advancing means for holding articles while they are displaced from the line.

5. Article transfer apparatus comprising:
frame means,
first and second stations fixed with respect to the frame means,
first and second reciprocating driving means mounted on the frame means and operatively connected to cams which are connected to a continuously rotating shaft which is connected to a source of power,
displacing means connected to the first driving means mounted on the frame for movement adjacent the stations and adapted to move articles away from and toward the stations in directions angularly related to a line common to the stations,
advancing means connected to the second driving means and mounted on the frame means adjacent the stations for moving articles in the direction of a line common to the stations, and
gripper means mounted in the advancing means for movement therewith, the gripper means resiliently overlying portions of the advancing means configured for holding articles.

6. Article transfer apparatus comprising:
frame means,
first and second stations fixed with respect to the frame means,
first and second reciprocating driving means mounted on the frame means and operatively connected to cams which are connected to a continuously rotating shaft which is connected to a source of power,
displacing means connected to the first driving means mounted on the frame for movement adjacent the stations and adapted to move articles away from and toward the stations in directions angularly related to a line common to the stations,
advancing means connected to the second driving means and mounted on the frame means adjacent the stations for moving articles in the direction of a line common to the stations,
wherein the displacing means is constrained for movement back and forth along the stations, wherein the

displacing means and the frame means define cooperating camming members which constrain the displacing means to move at an angle to the stations when the drive means operates the displacing means, wherein the advancing means is slideably interconnected with the displacing means for movement therewith, and wherein the advancing means is configured to receive articles at the first station and to release articles at the second station, whereby the reciprocating driving means cooperate with the displacing and advancing means to move the displacing means, thus relatively moving the camming members, causing the displacing and advancing means to move away from and then toward a line connecting the stations, the driving means and the advancing means cooperating to move the article in the direction of a line connecting the stations while the advancing means is displaced therefrom, whereby the advancing means receives an article from the first station, is displaced from a line between the stations, moves in the direction of the line, moves toward the line and releases an article at the second station.

7. Article transfer apparatus comprising:

frame means,

first and second stations fixed with respect to the frame means,

first and second reciprocating driving means mounted on the frame means and operatively connected to cams which are connected to a continuously rotating shaft which is connected to a source of power,

displacing means connected to the first driving means mounted on the frame for movement adjacent the stations and adapted to move articles away from and toward the stations in directions angularly related to a line common to the stations,

advancing means connected to the second driving means and mounted on the frame means adjacent the stations for moving articles in the direction of a line common to the stations,

wherein the displacing means comprises a first pair of horizontally oriented bars disposed on opposite sides of the stations and defining sloped cam surfaces, wherein the frame means has stationary members cooperating with the cam surfaces, wherein the advancing means comprise a second pair of spaced horizontal bars overlying the first pair and interengaging the first pair for relative longitudinal sliding and for prevention of relative vertical movement therebetween, the second pair of bars defining opposite recesses in inward upper edges thereof, the recesses being spaced at lengths along the bars commensurate with lengths between adjacent stations.

8. The article transfer apparatus of claim 7 wherein the advancing means further comprise retainer means have arms intermediately pivoted on pins extending laterally therefrom, the arms having inner ends overlying at least portions of the recesses, and being resiliently urged toward the recesses.

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U.S. Cl. X.R.

198—218, 219, 225; 214—1